PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Patents Office
Government Buildings
Hebron Road
Kilkenny

I HEREBY CERTIFY that annexed hereto is a true copy of the documents filed in connection with the following patent application:

Application No.	2002/0739
Date of Filing	11th September 2002
Applicant	Henkel Loctite Deutschland GMBH, of Arabellastrasse 17, Munchen, Germany

Dated this 16 day of September 2003.

An officer authorised by the
Controller of Patents, Designs and Trademarks.

02-0739

Form No.1

REQUEST FOR THE GRANT OF A PATENT

Patents Act, 1992

The Applicant(s) named herein hereby request(s)

☒ the grant of a patent under Part II of the Act

☐ the grant of a short term patent under Part III of the Act on the basis of the information furnished hereunder

1. Applicant(s)

Name: **HENKEL LOCTITE DEUTSCHLAND GMBH**

Address: **Arabellastrasse 17, 81925 Munchen, Germany**

Description/Nationality :

2. Title of Invention:

An Apparatus for the Application of a Curable Composition to a Fastener

3. Declaration of Priority on basis of previously filed application(s) for same invention (Sections 25 & 26)

Previous Filing Date	Country in or for which filed	Filing No.

4. Identification of Inventor(s):

Name(s) of person(s) believed by applicants to be the inventor(s) address:
Matthias HALLER of Wiesenfeldstrasse 11
65936 Frankfurt,Germany

5. Statement of right to be granted a patent (Section 17(2) (b))

Date of assignment from inventors:
9th September 2002

6. Items accompanying this Request - tick as appropriate

(i) ☒ prescribed filing fee

(ii) ☒ specification containing a description and claims
☐ specification containing a description only
☒ Drawings to be referred to in description or claims

(iii) ☐ An abstract

(iv) ☐ Copy of previous application(s) whose priority is claimed

(v) ☐ Translation of previous application whose priority is claimed

(vi) ☒ Authorisation of Agent (this may be given at 8 below if this request is signed by the applicant(s))

7. Divisional Application(s)

The following is applicable to the present application which is made under Section 24 -

Earlier Application No:
Filing Date:

8. Agent

The following is authorised to act as agent in all proceedings connected with the obtaining of a patent to which this request relates and in relation to any patent granted -

Name	Address
TOMKINS & CO.	**5 Dartmouth Road, Dublin 6.**

9. Address for Service (if different from that at 8)

TOMKINS & CO., at their address as recorded for the time being in the Register of Patent Agents.

Signed Name(s):
by:
Capacity (if the applicant is a body corporate):

Date: **11 September 2002**

Title

An Apparatus For The Application Of A Curable Composition To A Fastener

Technical Field of the Invention

The present invention relates to an apparatus for the application of a curable composition to a fastener. In particular, the invention relates to an apparatus for the application of an at least two stage curable composition to a fastener.

Background of the Invention

It is known to provide an apparatus for applying material to fasteners, in particular, threaded fasteners. One of the problems which have been associated with conventional apparatus for applying composition includes the problem of contact marks. Contact marks arise where fasteners touch off each other during the coating process. If the coating is not dry to touch then some of the coating may come off onto another fastener, leaving a mark where contact was made (on one or both fasteners). Such marks are known as contact marks.

One of the reasons for eliminating contact mark problems includes improving the appearance of the end product. In particular, it is desirable that fasteners will have composition only where it is required and will not have small amounts of the composition on other parts of the fastener which detract from the aesthetic appearance of the fasteners.

Having product on undesired parts of the fastener can also deleteriously affect the handling of the fasteners by automated machines (for example, robotic machines such as robotic grippers and the like). Due to the continued automation of assembly lines, etc., it is desirable that fasteners can be handled by automated machines, for example, machines for placing the fastener in a fastening position, and/or fastening parts mechanically with the fasteners. Such automated apparatus will normally be designed to grip the fastener at a part of the fastener which has not had composition applied. This is to ensure that composition does not find its way onto the handling apparatus for the fastener. However, if composition has made its way onto other parts of the fastener (as discussed above), then it tends to come off on the handling apparatus, eventually causing problems with gripping of fasteners. It may interfere with moving parts of at

least that part of the apparatus which grips the fastener, etc. Other methods of handling fasteners include pneumatic lines (often referred to as "shoots") which essentially are hollow tubes through which the fasteners are blown by compressed air pressure. The fasteners can clog up in the tubes if the interior of the tubes become soiled with composition due to contact of the fastener with the tube (contact marks on the interior of the tube). Accordingly it is desirably that any coating applied is substantially dry to touch when being passed through such systems.

Some apparatus which have been provided for applying coatings to fasteners include a drying oven in the form of a high temperature oven which is used to dry the composition. There are inefficiencies in the process, as the amount of energy required to dry the composition is high. Furthermore, batching the fasteners together for drying in the oven can lead to contact marks, as discussed above. Evaporation of water and/or solvent may create contaminated extracted air which is another potential disadvantage.

It is desirable, therefore, to provide a handling mechanism that can carry components through both the coating and drying processes to create a dry-to-touch composition applied to the fastener without creating an opportunity for contact marks to be formed by collision of fasteners. It is also desirable to provide a compact apparatus for application of curable composition. It is also desirable to provide an apparatus which can have high through-put of components which are coated, again, suitably in a compact arrangement.

One such handling apparatus is described in US Patent No. 6,027,568 to Wallace et al. Wallace et al. describe an apparatus and method for providing a masking, insulating and/lubricating barrier coating on a portion of threads of fasteners. The apparatus employs applicator guns which fire a jet of composition onto the fasteners. The fasteners are conveyed along the apparatus by a conveyor and are delivered to an oven where they are dried. Accordingly, it is likely that contact marks would be formed in batching of the fasteners for drying in an oven. The compositions applied are not curable.

UK Patent Application No. GB 2 255 781 describes a composition which is UV-curable and which is applied to fasteners by an apparatus. The apparatus includes a conveyor having two spaced apart belts for conveying fasteners from a loading station

past applicators and a heating station to a UV station. The fasteners are caught between the two belts with two opposing sides at the head of the fastener resting on the top of the belts and the stem of the fastener depending vertically downwards in which position they are held throughout the processing steps.

Summary of the Invention

The present invention defines an apparatus and system for the application to a fastener of a composition curable by irradiation.

Accordingly, the present invention provides an apparatus for the application of an at least two-stage curable composition to a fastener comprising:

(i) a conveyor for conveying fasteners to an application station;

(ii) an application station comprising an applicator from which the composition is dispensed, the conveyor for rotating at least part of the fasteners past the applicator for application of composition to the fasteners;

(iii) a conveyor for conveying the fasteners to an irradiation station and arranged to rotate the fasteners for irradiation thereof; and

(iv) an irradiation station for curing the composition applied to each fastener.

The apparatus of the present invention is able to handle and coat various types of threaded parts, in particular, male threaded parts. The flexibility of the apparatus to coat large numbers of different parts is quite advantageous. The end-users of the parts may require an approval procedure for each type of part they use. Accordingly, if the parts are coated by different procedures, a different approved procedure may be required. This is not so with the present invention, where the same apparatus can handle different sizes of fasteners.

The apparatus of the invention is suited to high production speed, for example, greater than 16,000 pieces per hour. The apparatus may be quite compact, for example, no longer than 2 metres in length. For example typical dimensions including a feeding

station are 2m x 2m x 1.5m (height x length x width). This reduces installation and user space required. The apparatus is also relatively portable, being quite easily moved from one location to another.

The conveyor for conveying fasteners to an application station may be the same conveyor as the conveyor for conveying the fasteners to an irradiation station. Desirably however they are separate (first and second) conveyors (conveyors which can run at different speeds for application and curing). In particular it is desirable that the apparatus comprises a first conveyor for conveying fasteners to an application station, and for rotating at least part of the fastener part of the application for application of composition to the fasteners. The second conveyor can then be used to convey the fasteners to irradiation station. While most of the discussion of the present invention refers to the presence of first and second conveyor it will be appreciated that the features of the first and second conveyors may be applied, as appropriate, to a single conveyor apparatus.

In one desirable arrangement the apparatus further comprises a fastener feeder for feeding fasteners one by one to a first conveyor. This allows for timely and orderly feeding of fasteners to the first conveyor. Many conveyors are of the movable support type i.e. of the type that support the material they carry. One example is a flat rubber belt which can carries product on its upper surface. Such conveyors do not normally continuously rotate (or roll) the material they carry. Conveyors which continuously rotate (or roll) the products they handle are desired for use in the present invention.

The composition will usually be on at least two-stage curable composition. The curable composition having a first cure stage which is activatable by irradiation, and a second cure stage which is curable to secure the fastener in a fastening position. The irradiation will normally cure the first stage cure of the composition.

The first conveyor desirably extends from the fastener feeder through the application station. The first conveyor may be arranged for conveying the fasteners in a manner so that the fasteners are arranged on the conveyor in a configuration each spaced

apart from the next, from the feeder to the application station (and suitably through the application station).

In particular it is desirable that the applicator comprises a surface onto which the product is dispensed. In one construction the fasteners are rolled across said surface by the first conveyor. Desirably, the applicator is provided in the form of a coating block. The coating block will have a surface across which the fasteners are rolled or such like. In particular, it is desirable that at least one dimension of the applicator may be altered (the contact made with the fastener can be varied). This allows the application of different widths of product to the fasteners. In particular, the applicator may have (a contact portion for contacting composition to the fastener with) a width corresponding to the width of a (continuous) band of product that is desired to apply to the fasteners. The width of the applicator can thus be varied to achieve differently sized bands of product about the fastener (usually confined to a portion of the fastener). A band of product will normally be continuous both circumferentially about the fastener and longitudinally along the fastener. It will be appreciated by those skilled in the art that as the fasteners are rolled across an applicator (with a contact portion for example with an application surface thereon) with composition thereon, a band of product will be applied circumferentially about the fastener.

In one embodiment, the applicator surface is adjustable for application of different bands of product to fasteners. In another embodiment, the component on which an applicator surface is formed, for example, a coating block, is an interchangeable part, so that different applicator surfaces (coating blocks) are mountable on the apparatus for use.

The second conveyor desirably extends through the irradiation station. The second conveyor may be arranged for conveying the fasteners in a manner so that the fasteners are arranged on the conveyor in a configuration each spaced apart from the next. In particular the second conveyor is used to convey the fasteners through the irradiation station.

The fasteners need not be conveyed or otherwise moved between the first and second conveyors. For example the momentum of a fastener exiting the first conveyer may be sufficient to carry the fastener to the second conveyor where it is picked up by motion of the second conveyor. Larger fasteners (i.e. those with greater momentum) in particular may be transferred (travel) between conveyors in this way.

In one embodiment it is desirable that the apparatus further comprises a transfer station for transferring the fasteners (from the first conveyor) to the second conveyor. The transfer station may comprise a (short) conveyor which acts to convey the fasteners between the (end of the) first and (the start of the) second conveyors. This is particularly useful for smaller fasteners.

In one compact arrangement it is desirable that the total length of the first and second conveyors is reduced. This may be achieved by at least partial overlap of the conveyors. In one arrangement the total distance from a fastener receiving end of the first conveyor to a fastener exiting end of the second conveyor measured in a horizontal plane (in the operating position of the apparatus) may be up to 50% less that the total combined length of the first and second conveyors.

One of the advantages in the provision of first and second conveyors is that the speed of each conveyor to be selected may be accomplished independently from the other. In particular the speed of the first conveyor (measured as the travelling speed of a fastener) is substantially faster than the speed of the second conveyor. It is also desirable that the first conveyor is arranged to convey the fasteners with a substantially greater lateral distance between the fasteners. In one arrangement of the invention the transfer of the fasteners from the first to the second conveyor may result in the fasteners being grouped together a smaller distance apart but in any case it is described that the fasteners are a shorter distance apart on the second conveyor. For example the distance between fasteners conveying by the first conveyor is desirably 4 to 10 times the width of the fastener. (If the fastener has a head then desirably the spacing is 4 to 6 times the width of the head.) In the second conveyor the spacing is desirably 1.5 to 2.5 times the width of the fastener (or of the fastener head). The speed of the first conveyor is typically 2 to 3 times the speed of the second conveyor. Typical speeds are 0.1 to 0.5m/s for example 0.22m/s for the first conveyor or typically has a speed of 0.05 to 0.2 m/s such as 0.09

m/s. The reduction of speed through the second conveyor and the closer together fasteners allow for a substantial reduction in the overall length of the first and second conveyors, thus reducing the overall length of the apparatus.

In particular at least one and desirably each of the first and second conveyors of the invention comprise at least one (endless) belt which is arranged to run substantially constantly spaced apart from a rail (it is also possible to use an (endless) chain or such like but a belt is preferred). The belt and the rail are suitably arranged to grip the fasteners between them so that motion of the belt (in at least one direction) causes the fasteners to roll along the rail. In this way the fasteners can be rotated and moved along at the same time. At least one rail may run from the applicator station through to the irradiation station.

Desirably the fastener is a threaded fastener such as a bolt, screw, plug, stud, fittings etc. Typically the threads of the fastener engage with reciprocal threads of a receiver for the fastener for example a threaded bore or nut and the composition (in particular stage two thereof) is activated on screw thread engagement of the fastener to act as a threadlocking composition to lock the threads together or as a thread sealant composition to provide a seal about (the threads of) the fastener. Threadlocking compositions are well known to those skilled in the art and are not described in detail herein. Desirably both the threadlocking and thread sealing compositions will have the two stage cure system described above. In particular it is desirable that the composition applied by the apparatus of the invention is a one-part composition (having a two-stage cure).

Desirably, the fasteners are conveyed by at least the first conveyor (and desirably the second conveyor also) so that they are substantially horizontal. The fasteners will normally be threaded. They may or may not have a head. The fasteners may or may not be ferromagnetic (e.g. steel, brass, stainless steel).

In one particularly desirable arrangement, the fastener comprises a first end and a second end with a stem portion between the first and second ends. Desirably, the apparatus comprises a rail for supporting the stem of the fastener at at least one location thereon (, at least while the fastener is being conveyed by the first conveyor). Desirably,

a rail is provided also, for supporting the fastener when it is conveyed by the second conveyor.

In one particularly desirable arrangement, two spaced apart rails are provided to support the fastener at at least two positions thereon. It is desirable that neither of said two positions coincides with the part of the fastener which has had, or is for, application of composition at least until the fastener is sufficiently far through the apparatus so that the composition is dry to touch.

The fasteners may typically be in the range from 5mm up to 200mm in length. Such fasteners do not need a head for transportation or for guidance along the apparatus. The invention is particularly suitable for use with threaded fasteners having a head portion and a stem portion thereon.

In one particularly desirable arrangement, suitably the rail or rails for supporting the fastener are adjustable so that different sizes (lengths) of fasteners may be accommodated by the apparatus. In particular, where two rails are provided, it is desirable that they are adjustable relative to each other so that the spacing between the rails may be varied as desired. Such rails are desirably of a narrow width, for example, between 1mm and 5mm in thickness. Desirably, two parallel rails are provided. Product may be applied to the portion of the fastener that is arranged to lie between the rails.

Desirably, the application station comprising a supply system for supplying curable composition to the flat applicator surface. In one embodiment, desirably the component on which the flat applicator surface is formed has one or more apertures defined therein which pass to and through the applicator surface so that the product may be provided through the apertures to the applicator surface.

Desirably, the conveyor comprises a belt of material, desirably flexible material. In particular, it is desirable that the belt comprises resiliently deformable material, and in one embodiment of the invention, comprises O ring material. An O ring is a closed loop of material where the cross section of the material making up the ring is substantially circular (O-shaped).

Desirably, the supply system for supplying composition to the application station includes an air pressurised line which pushes product from a product reservoir along a conduit to the applicator. Desirably, a control is provided for controlling the rate of product supply. The applicator desirably has a spreading surface onto which the composition is dispensed. The spreading surface may or may not be recessed so that product is present below a surface of the applicator across which the fasteners are rolled.

The products coated by the apparatus of the present invention are dry to touch, and thus can be collected in batches (in contact with each other) without fear of contact marks developing on some of the components. The present invention achieves substantially no contact marks on pieces which have been processed by the apparatus of the present invention. For example, even with 16,000 pieces an hour being processed, very low percentages of these products would have to be rejected due to contact marks. Contact marks would generally appear on less than 1% of the pieces and, in particular, less than 0.1% of pieces using the process of the invention. Markings on less than 0.035% of fasteners has been achieved while 0.005% or less is possible (50 pieces in a million).

Desirably, the irradiation station comprises a UV light source for irradiating product with UV light. In such instances, it is desirable that the first cure stage of the curable composition is activatable by UV light. Desirably, the UV light source is a high intensity lamp, typically having an output of 120W/cm. The fastener may experience an intensity of 40m/Wcm^2. Desirably the irradiation station comprises a focused radiation emitting source, such as for example a focused UV source for example the light source may be housed in a reflective housing which focuses the UV light into a narrow band. For larger bolts in particular the irradiation time is not so critical and a lower intensity source may be used.

It will be appreciated by those skilled in the art, that the limit of the capacity of the apparatus of the present invention to carry articles for application of coating is limited by the smallest size of conveyor that can convey the piece and leave sufficient of the fastener unobstructed for application of a coating.

Desirably, the first conveyor and the application station are arranged in-line.

The invention extends to apparatus substantially as described herein with reference to and/or as illustrated in the accompanying drawings.

Brief Description of the Drawings

Figure 1 is a schematic representation of an apparatus according to the present invention;

Figure 2 is a side elevation showing a more detailed construction of an apparatus of the present invention;

Figure 3 is an end part sectional view of the apparatus of Figure 2 (from the left end thereof); and

Figure 4 is an enlarged partial view similar to that of Figure 3.

Detailed Description of the Drawings

Figure 1 shows a schematic representation of an apparatus according the present invention. The apparatus is for the application of a two-stage curable composition to fasteners. The two-stage composition is desirably a one-part composition. The advantage of using a one-part composition is that application of the composition can take place in one step. If the composition is a two-part composition then application of the two-parts of the composition must normally take place separately as mixing of the two-parts of the composition will cause the composition to cure.

The apparatus 1 has a conveyor for conveying fasteners 2 to an application station which in the embodiment is a coating block 5. A first conveyor is provided which includes an endless belt 3 (in Figure 1 only part of the belt is shown) which conveys the fasteners on bolts to the coating block 5. It will be noted that the endless belt 3 picks up the fasteners 2 and conveys them through the application station. The conveyor 3 extends through the application station (passing across the coating block 5).

The coating block 5 is a component of the apparatus that is replaceable and different sizes of coating blocks can be used to achieve different amounts of applied product on the fasteners. Also provided is a second conveyor in the form of an endless belt 8 which is for conveying fasteners 2 to an irradiation station which in the embodiment is a focused UV light assembly 10. In particular the assembly 10 has a UV emitting light 11 housed in a closed housing 12 (in Figure 1 the housing is shown in part cut-away to show the internal UV light). An elongate aperture 13 is formed in the base of the housing 12 which allows a narrow band of UV light to escape from the housing 12. A cover (such as a sliding cover) may be provided over the slot. The narrow band of UV light is arranged to be coincident with a band of applied composition 9 on the fasteners.

The band of applied composition 9 is achieved by rotating the fasteners across the coating block 5. In particular the coating block 5 has a contact portion for contacting the composition with the fastener. The contact portion is provided in the form of an application surface 14 (on coating block 5) onto which the two-stage curable composition is dispensed. In the embodiment shown, beads 6 of the (liquid) composition are dispensed onto the application surface 14 from the underside of the coating blocking 5. This may be achieved by providing apertures in the coating block which open onto the application surface 14 and for example using a conventional dispensing system such as an air-pressurised line etc. The apparatus 1 also has a rail 4 (see also Figures 3 and 4) which supports the fastener close to one end of (the end closest the head) the fastener. The fasteners 2 are gripped between the belt 3 and the rail 4 sufficiently well so that movement of the belt 3 in the direction of the arrow 16 (left to right in the orientation shown) results in the bolt moving in the direction of the arrow 16 all the while rotating (rolling) as indicated by arrow 17.

In the embodiment the coating block 5 forms (part of) a second rail which also supports the fastener 2. Movement of the belt 3 thus causes the fasteners 2 to rotate across rail 4 and application surface 14 of the coating blocks causing the fastener to roll through the product 6 thus creating a band 9 of applied composition. It will be appreciated that rotation of the fastener is about a longitudinal axis thereof.

The fasteners continue to rotate (again about a longitudinal axis) while passing under the irradiation assembly 10 (rotation being effected by the second conveyor). The emitted UV light (radiation) from the assembly 10 is arranged to irradiate the bands 9 of product so as to cure the composition so it is dry to touch. The apparatus further comprises a feed - in means (fastener feeder) 15 which will, together with the remainder of the apparatus, be described in more detail with reference to Figures 2 - 4.

The apparatus of the invention sits on a general support which has been labelled 20. The apparatus has a fastener feeder 15 for feeding fasteners one by one to the first conveyor belt tray. As can been seen from Figure 2 the belt 3 runs in a series of pulley wheels 22 arranged in line. The belt 3 is driven by a motorised pulley wheel 23. An adjustable (tensioning) pulley wheel 24 is provided which can be used to tension the belt 3 as appropriate. All of the pulley wheels are supported on an adjustable support frame 21.

In particular an adjusting mechanism is provided which is operated by rotation of a hand wheel 25. In particular the relative distance between the belt 3 and the support 20 can be adjusted to accommodate different sizes of bolts. In particular the distance between the belt 3 and the support rail 4 (see Figures 1 and 3 - 4) can be adjusted so that different size of fasteners can be accommodated between the belt and the support rail 4. As described in Figure 1 the coating block 5 is also provided for application of composition to at least a portion of each of the fasteners 2.

The belt 8 works in an analogous fashion running across pulley wheels 26 and been driven by a motorised pulley wheel 27 and tensioned by a further tensioning wheel 28. The belt 8 and its associated pulley wheels 26-28 are all mounted on an adjustable support 30 which can be adjusted by turning handwheel 29 to alter the vertical distance between the belt 8 and the guide rail 4 (and the second rail 31).

If the fasteners have sufficient momentum, no additional mechanism may be needed to effect transfer the fasteners from belt 3 to belt 8, as at least certain fasteners may continue to roll along between exiting from belt 3 and before being picked up by belt 8. However it is desirable (especially for smaller fasteners) to provide a transfer mechanism between the two belts.

In the embodiment shown in Figure 2 the last pulley wheel 37 (last in the direction left to right) and the first pulley wheel 33 (again first in the same direction)

have arranged between them a transfer belt 32. The transfer belt 32 does not run directly between pulley wheels 37 and 33. This is because belts 3 and 8 run at different speeds. It is only necessary that the transfer belt 32 is driven at one end and runs on a (free wheeling) separate pulley on the other. In the embodiment the belt 32 turns with the of pulley wheel 37 while it free wheels on a separate pulley wheel at its other end (proximate first pulley wheel 26). As best seen from Figure 3 the pulley wheel 37 is double grooved having grooves 38 and 39 in which the belts 3 and 32 respectively run. The transfer belt 32 ensures smooth transition of smaller pieces between the two larger belts 3 and 8.

As described in Figure 1 light assembly 10 is provided to shine UV light on the applied product as discussed.

It will be appreciated that the bolts are continually rotated on a longitudinal axis when passing through the machine. Furthermore the fasteners are in a generally horizontal position. This is advantageous as the light source can be placed above the fastener rather than along side it or beneath it so that it is less likely that product would come off the fasteners 2 and land on the lamp assembly 10. Fasteners exiting the apparatus have been labelled 34 for convenience.

Figures 3 and 4 show a more detailed view which is part-sectional. In the view of Figures 3 and 4 the fastener feeder 15 has been omitted for the purposes of clarity. As can be seen clearly from these Figures the support 21 can be moved vertically relative to the rails 4 and 31(which in turn moves the pulley wheels 22-24 and 37 as described previously) by virtue of an adjusting mechanism 40 which is operated by the rotation of handwheel 25. In the view shown in Figures 3-4 the rail 31 does not appear as the view has been taken where the coating block 5 forms part of the second rail.

It will be noted from Figures 3 and 4 that a guide is provided each side of the fastener to keep the fastener on the rails 4,31 through the entire apparatus. In particular a first guide 43 and a second guide 44 guide the fastener along its travel path. In particular the first guide 43 is in the form of an abutment plate against which the head 45 of the

fastener abuts. The second guide 44 is also in the form on abutment plate against which the stem 46 of the fastener abuts. The guides 43,44 maintain the fastener on its path by preventing any substantial movement of the fasteners transversely across the rails.

It will be noted that the spacing between the rail 4 and the guide 43 is such that they form stops on opposing sides of the head (i.e. arranged to abut the top side and the underside of the head of the fastener) thus preventing the fasteners from moving off line to any great extent (by restricting movement of the head). The rail 4 and the guide 43 assist in preventing the fasteners arranging themselves in a diagonal direction across the rails.

All of support 21 and the pulleys belts etc. are supported by the adjustment mechanism 40 and movement thereof allows the relative vertical distance between the rails 4 and 31 and in particular the belt 3 to be adjusted.

Six rods 41, 42, 47 - 50 (see Figure 2) (arranged substantially horizontally and) vertically spaced apart form part of an adjustment mechanism which is arranged to allow for adjustment of the apparatus to accommodate differently sized fasteners 2 (in particular those of greater width). Only two of the rods 41 and 42 are shown in view of Figure 3. In particular a slide mechanism operates along rods 41,42 to allow adjustment of the apparatus in an essentially horizontal direction. In particular a clamp or lock 35 can be released which allows for the substantially horizontal movement of support 21 and all of its associated components together with the coating block 5, (block 5 moves on support 36) rail 31 and guide 44 to be moved closer or further away from the remainder of the apparatus (for example rail 4). This allows for in particular longer fasteners to be coated using the apparatus of the invention.

The rail 4 and the first guide 43 are adjustable relative to each other so that the distance between them can be selected allowing for use of the apparatus with fasteners having differently sized heads.

An enlarged view of part of the apparatus shown in Figure can be seen in Figure 4.

The entire process is carried out as follows:

The fasteners are fed into the first conveyor by a fastener feeder;

The conveyor conveys the bolts across an applicator which applies product to the bolts, the bolts are then transferred a second conveyor which runs at a different (slower) speed;

The second conveyor conveys the bolts pass the UV light source for curing of the product applied in the application station. By the time the bolts leave the second conveyor (see for example the bolts labelled 34 in Figure 2) they are dry to touch.

It is appreciated that certain features of the invention, which are, for clarity, described in the context of separate embodiments, may also be provided in combination in a single embodiment. Conversely, various features of the invention which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination.

The words "comprises/comprising" and the words "having/including" when used herein with reference to the present invention are used to specify the presence of stated features, integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

Claims

1. An apparatus for the application of a composition curable by irradiation to a fastener,

comprising:

(i) a conveyor for conveying fasteners to an application station;

(ii) an application station comprising an applicator from which the composition is dispensed, the conveyor for rotating at least part of the fasteners past the applicator for application of composition to the fasteners;

(iii) a conveyor for conveying the fasteners to an irradiation station and arranged to rotate the fasteners for irradiation thereof; and

(iv) an irradiation station for curing the composition applied to each fastener.

2. An apparatus according to claim 1 wherein a first conveyor is provided for conveying fasteners to the application station, and a second conveyor is provided for conveying the fasteners to an irradiation station.

3. An apparatus according to claim 1 or claim 2 wherein the composition is an at least two stage curable composition;

the curable composition having a first cure stage which is activatable by irradiation, and a second cure stage which is curable to secure the fastener in a fastening position.

4. An apparatus according to claim 2 or claim 3 further comprising a fastener feeder for feeding fasteners one by one to the first conveyor.

5. An apparatus according to any one of claims 2 to 4 wherein the first conveyor extends through the application station.

6. An apparatus according to any preceding claim wherein the applicator is a coating block.

7. An apparatus according to any preceding claim wherein at least one dimension of the applicator may be altered.

8. An apparatus according to any one of claims 2 to 7 wherein the first conveyor is arranged for conveying the fasteners in a configuration each spaced apart from the next.

9. An apparatus according to any one of claims 2 to 8 wherein the second conveyor is arranged for conveying the fasteners in a configuration each spaced apart from the next.

10. An apparatus according to any one of claims 2 to 9 wherein the apparatus further comprises a transfer mechanism for transferring the fasteners to the second conveyor.

11. An apparatus according to claim 10 wherein the transfer mechanism is a conveyor.

12. An apparatus according to any one of claims 2 to 11 wherein the fasteners are conveyed by the first and/or second conveyor so that they are substantially horizontal.

13. An apparatus according to any one of claims 2 to 12 wherein the apparatus further comprises a rail for supporting the fasteners at least while the fastener is being conveyed by the first conveyor.

14. An apparatus according to any one of claims 2 to 13 wherein the apparatus comprises a rail for supporting the fasteners while being conveyed by the second conveyor.

15. An apparatus according to claim 13 or 14 wherein the first and/or second conveyor comprises an endless belt which grips the fasteners between the belt and the rail so that movement of the belt moves the bolts along the rail.

16. An apparatus according to any preceding claim wherein two spaced apart rails are provided to support the fastener at at least two positions thereon during conveying of the fasteners.

17. An apparatus according to any one of claims 13 to 16 wherein the rail or rails for supporting the fasteners are adjustable so that different sizes of fasteners may be accommodated by the apparatus.

18. An apparatus according to any preceding claim wherein the application station comprises a supply system for supplying curable composition to the applicator.

19. An apparatus according to any preceding claim wherein the applicator has one or more apertures defined therein so that composition may be provided through the apertures to a surface on the applicator from an underside thereof.

21. An apparatus according to any one of claims 2 to 19 wherein the first and/or second conveyor comprises an endless belt of material.

22. An apparatus according to claim 20 wherein said belt of material comprises resiliently deformable material.

23. An apparatus according to any preceding claim wherein the irradiation station comprises a UV light source for irradiating applied composition with UV light.

23. An apparatus according to claim 20 wherein the UV light source is a high intensity lamp, typically having an output of $120W/cm^2$.

24. An apparatus according to any preceding claim wherein the irradiation station comprises a focused radiation source.

25. An apparatus according to claim 24 wherein the irradiation station comprises a radiation source housed in a enclosure which focuses the radiation through an aperture therein.

26. An apparatus according to claim 25 wherein the aperture is arranged to focus a band of radiation onto the part of the fastener for receiving applied composition.

27. An apparatus substantially as described herein with reference to and/or as illustrated in the accompanying drawings.

Tomkins & Co.

spec1026

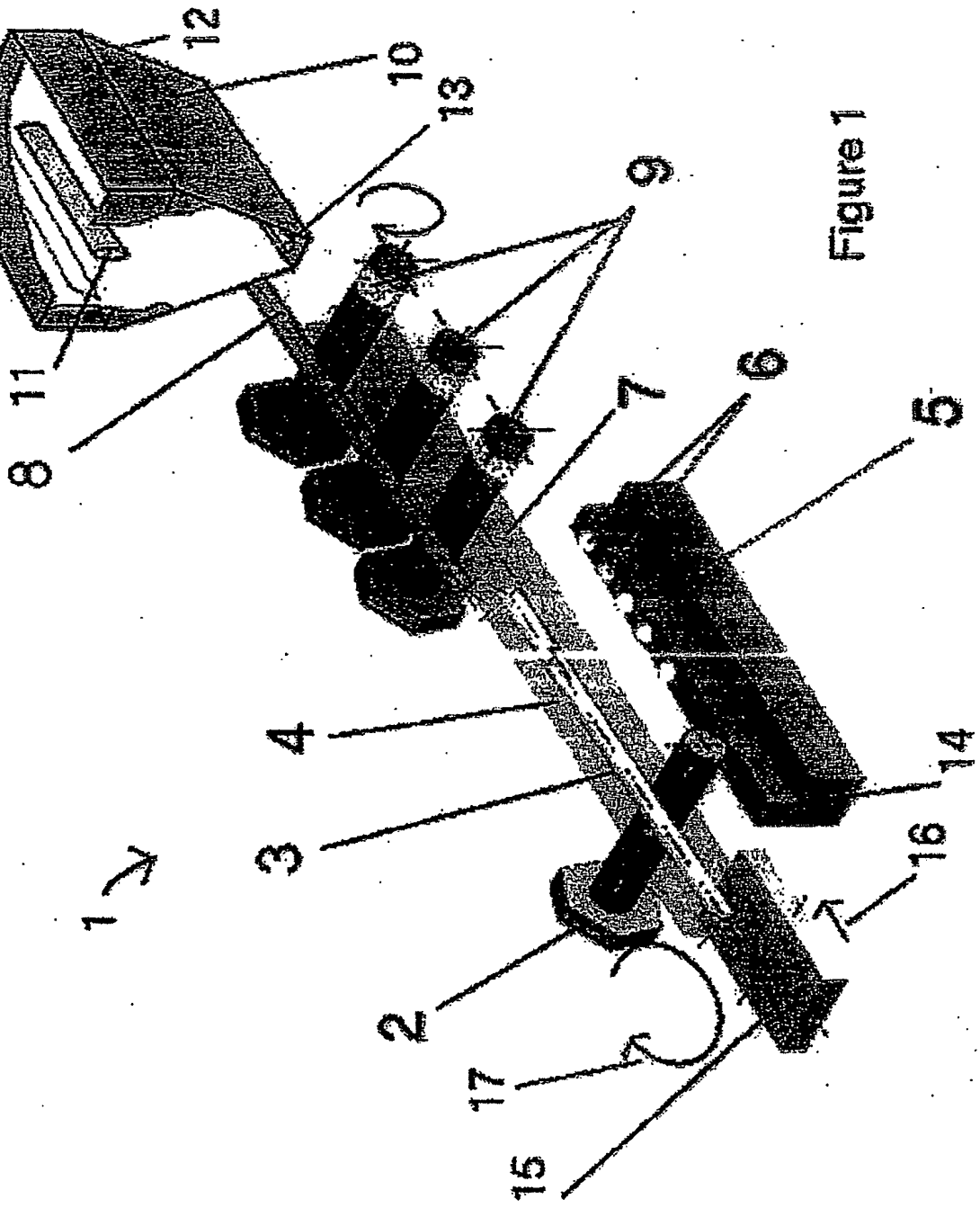

Figure 1

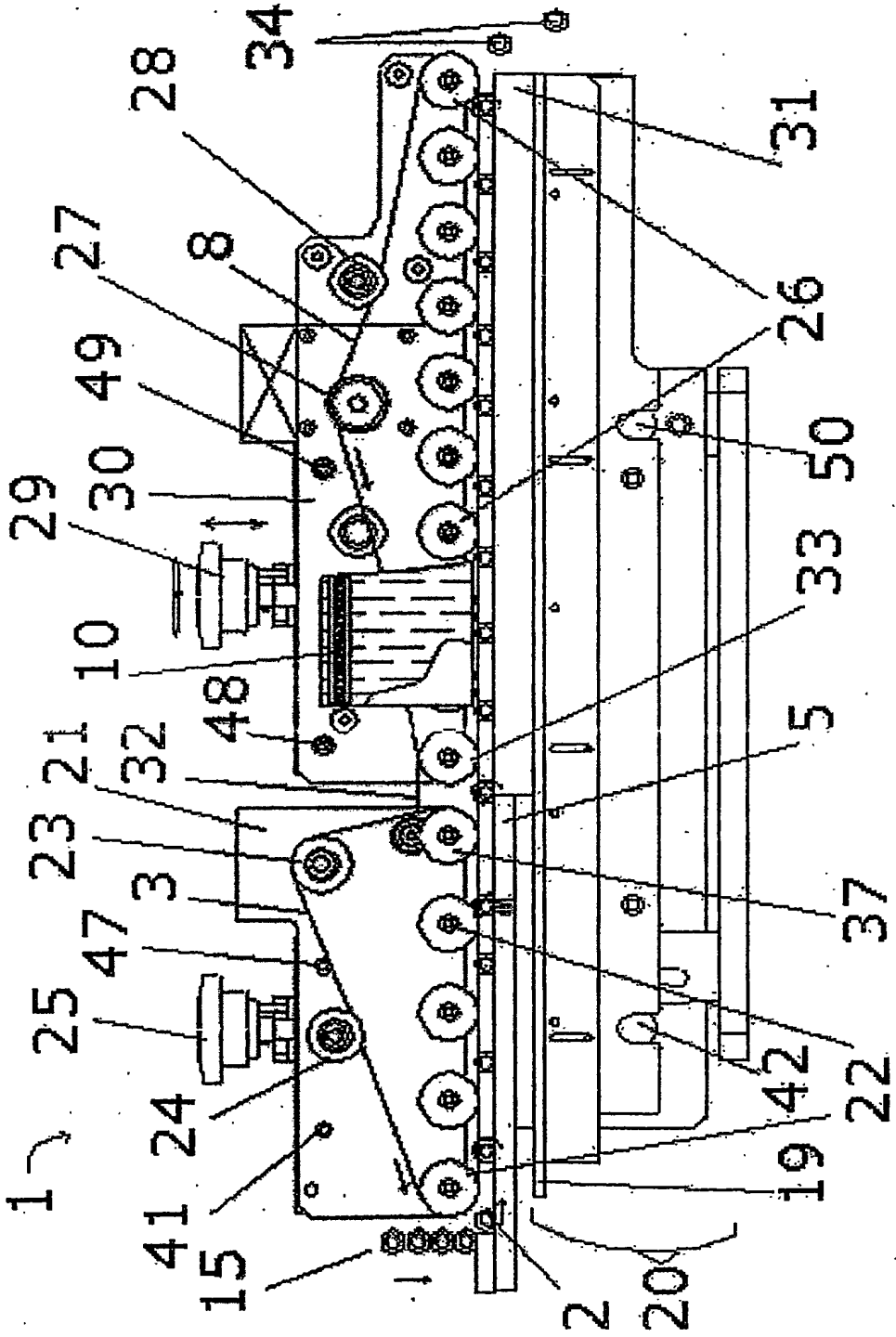
34
28
31
27
8
26
49
50
30
29
33
10
48
5
21
32
23
37
3
47
25
22
42
24
1
19
41
15
2
20

Figura.2

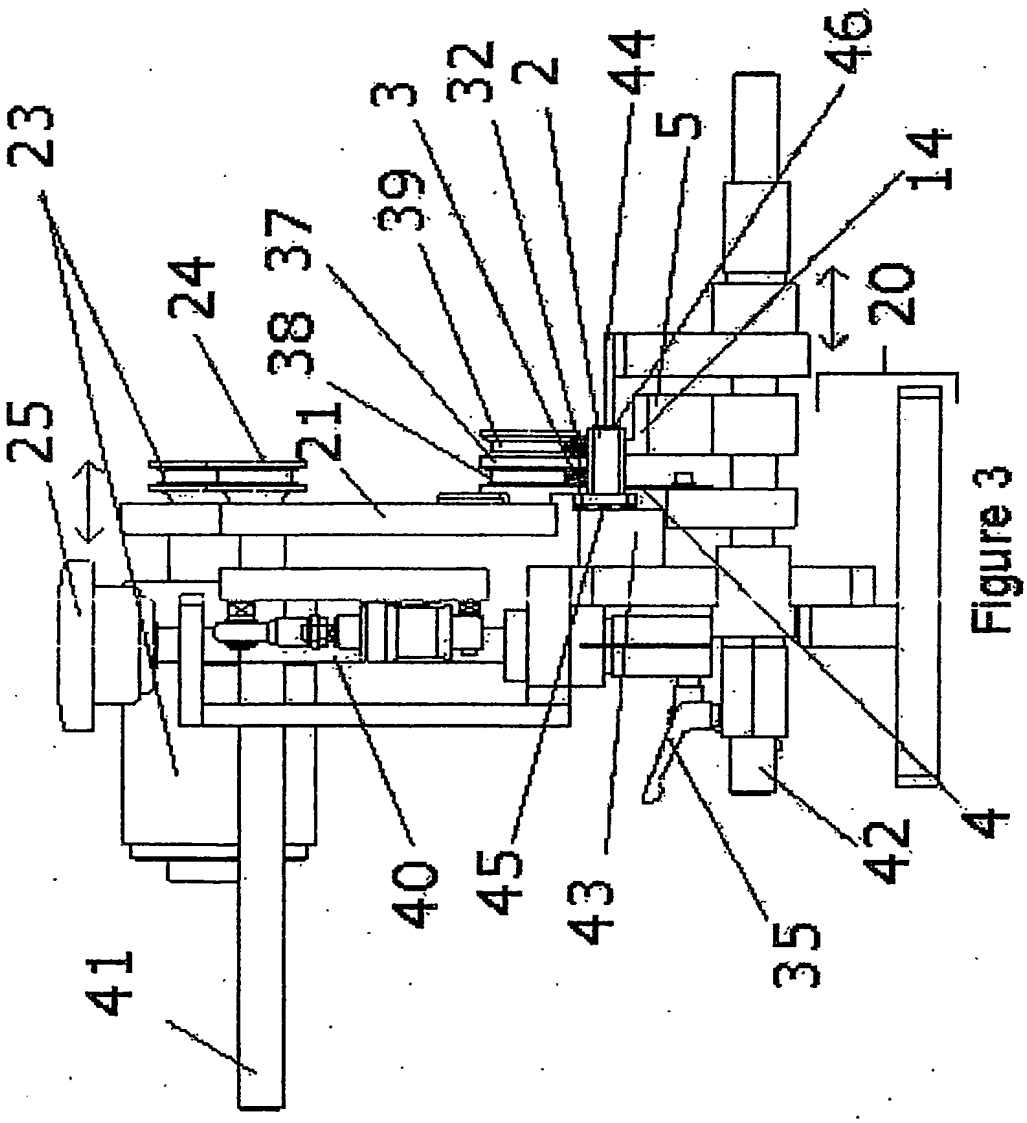

Figure 3

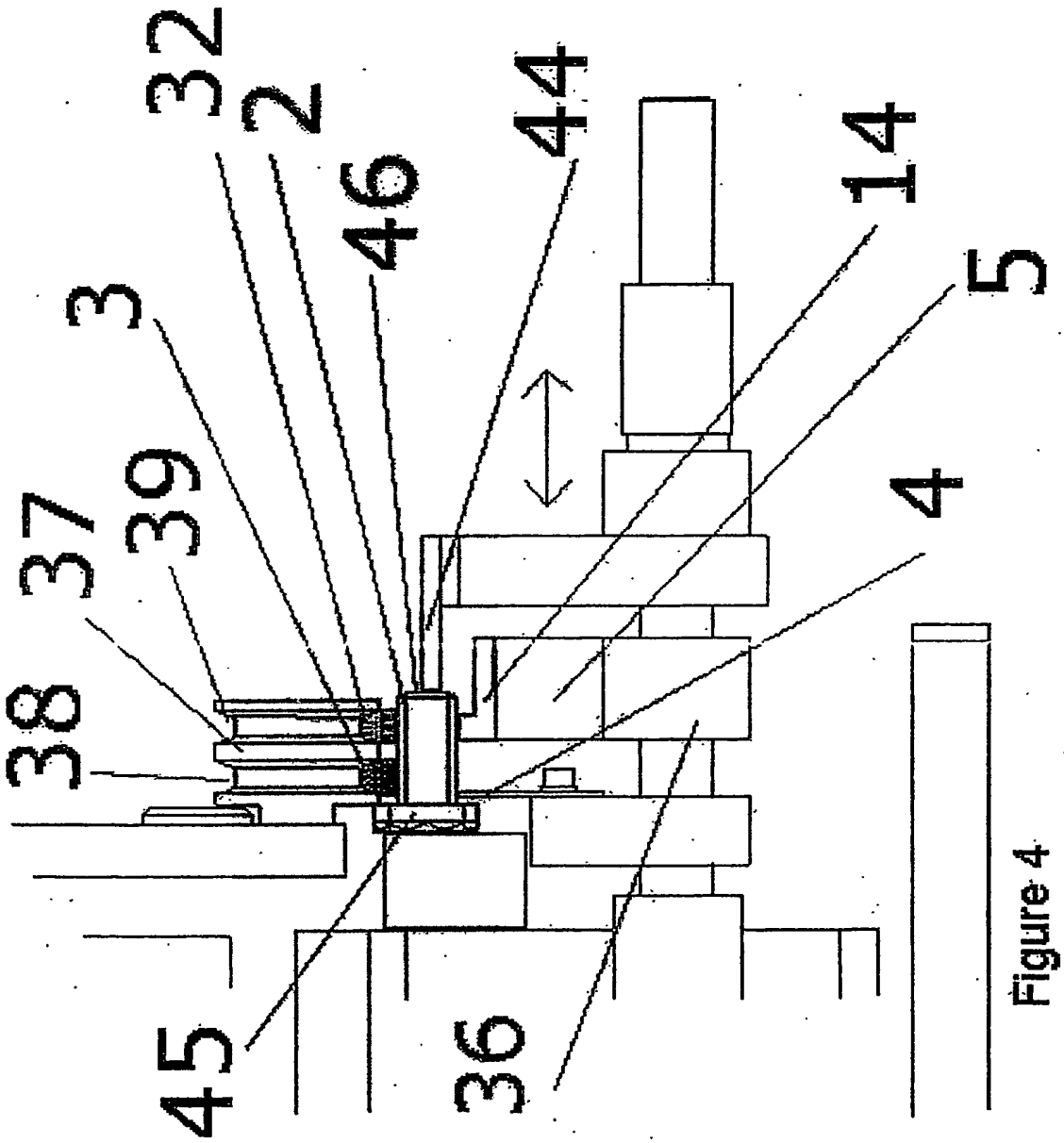

Figure 4